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ABSTRACT

A six month study attempted a forecast of growth and development in the 1980s for the city of Tacoma, Washington and the Tacoma School District. Section one of the study's report focuses on demographic and economic issues. Figures are presented that show possible trends in general population growth, per capita income, retail sales, and housing. The second section provides forecasts of total enrollments for elementary, junior high, and senior high schools. In section three the projected growth in ethnic student enrollments is shown, and special attention is given to projected enrollments of black students. The final section includes a description of the research materials and methodologies used to obtain the various forecasts. (APM)

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THE DECADE AHEAD
A FORECAST OF THE TACOMA SCHOOL DISTRICT IN THE 1980's

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A REPORT TO THE TACOMA SCHOOL BOARD

By
Dr. Mitchel F. Bloom
July 10, 1980

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THE DECADE AHEAD

A FORECAST OF THE TACOMA SCHOOL DISTRICT IN THE 1980'S

A REPORT TO THE TACOMA SCHOOL BOARD

BY

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SUMMARY OF RESULTS

> INTRODUCTION <

This is a summary of a six month study which had as its goal to forecast the standard future for both the city of Tacoma and for the Tacoma School District #10. The principal purpose of the study is to project what the city of Tacoma and the Tacoma public schools will most probably look like in the 1980's if past trends continue.

This summary will deal with the highlights of the findings. The details, consisting of supporting data, forecasting assumptions and methodology, are contained in the complete report.

> TACOMA AND PIERCE COUNTY <

The 1980 population of Tacoma is estimated at 162,000. By 1985 it is expected to rise to 168,000 and by 1990 it will reach 171,000 (see Fig. 1). This means that Tacoma will be growing at a rate of 5.6% in the 80's compared to 5.2% in the 70's. By way of contrast, Pierce County is expected to grow at 15.2% in the 80's compared to 14.5% in the 70's, or nearly three times faster than Tacoma.

In the next decade, employment in Pierce County is projected to grow by 35,000 new jobs or nearly one new job for every four that exist today. The employment sectors experiencing the largest gains will be the services (45%) and the wholesale and retail trade (33%).

Although family income will have increased, the price of a housing unit relative to family income will have doubled compared to the early 70's. In practical terms, it will be twice as difficult for a young couple to buy a home in 1990 as it was for their parents in 1970.

Finally, retail sales in the county will have nearly doubled by the end of the decade (measured in inflated, or current, dollars) resulting in the average household spending more, saving less and going further into debt.

This broad picture of the Tacoma-Pierce County population and economy should serve as background to the forecasts of city school enrollments which will be discussed next.

***> FUTURE ENROLLMENT OF TACOMA PUBLIC SCHOOLS> ***

Total public school enrollment is projected to increase from 27,800 in 1980 to 28,800 by 1985 and finally to 31,000 by 1990 (see Fig. 2). In percentage terms, the public school population is expected to increase by 11.4% in the 1980's, starting out with slow growth (3.7%) in the first five years and doubling that rate of growth in the last half of the decade.

Elementary school enrollment will account for the largest part of the total enrollment increase in the next decade. From an enrollment of 14,800 pupils (excluding handicapped) in 1980, the elementary schools are expected to have 17,200 pupils by 1990 (see Fig. 3). This means an increase of 16.3% over the decade. The increase in elementary pupils is significant because it represents a continuation of a reversal begun in 1979 from the steady decline in elementary pupils in the 70's. This increase is mainly the result of (1) the projected increase in the Tacoma birth rate (already observed to have jumped an average of 10% per year over the last four years) and (2) the children of new families who will move into 6400 planned new housing units throughout the city.

Junior high school enrollment is expected to increase by a moderate 11.5% in the 80's. Most of the increase will take place in the second half of the decade. The enrollment of junior high schools will rise from 6400 pupils in 1980 to 7200 in 1990 (see Fig. 4).

In contrast to both elementary and junior high school enrollment increases, the number of high school students is projected to stay at about the 6500 level during the 1980's. In the first half of the decade a 2.8% drop is projected followed by a 3% gain in the last half of the decade (see Fig. 5). During the 1980's the high schools will still be feeling the low birth rates of the 1960's and 1970's. Consequently, we must wait until the 1990's before seeing increases in the high schools similar to those forecasted for the elementary and junior high schools in the 1980's.

> ETHNIC ENROLLMENT <

In 1980 the total ethnic population of the Tacoma public schools is estimated at 6500 pupils. By 1990 this population is projected to equal 9900 pupils or a gain of 55% (see Fig. 6).

Black enrollment is projected to increase at a lower rate than total ethnic enrollment. The Black student population is forecasted to increase from 4100 in 1980 to 5800 in 1990. This represents a gain of 44% over the decade or approximately four times the percent rate of increase projected for the district as a whole (11% as stated previously).

The largest percentage change in ethnic pupils occurs in the category of "Other Ethnics", which includes Asian, Hispanic and Native American. This group, which is currently at a level of 2400 pupils, is projected to rise to 4100 by 1990, an increase of 74% over the next ten years. Many of these ethnic pupils are children of Asian refugees. Because the U.S. is accepting 14,000 refugees per month from Indo-China, with no end in sight, in addition to the Cuban refugees, estimates of this group even may be on the low side.

A better understanding of the growth of ethnic pupils can be gotten by calculating the percentages of the ethnic groups relative to the total public school population. In 1980, the Black pupil population accounts for 14.7% of the total; by 1990, this group will account for 18.7%. The Other Ethnic percentage of the total will increase at a far higher rate, rising from 8.6% in 1980 to 13.2% in 1990. Taken as a whole, the total ethnic pupil population will increase from 23.4% of the total enrollment in 1980 to 31.9% in 1990. To summarize, whereas today one out of four pupils is a member of a minority group, in ten years time it will be one out of three pupils.

> THE EXPANSION OR CLOSING OF SCHOOLS <

This brief summary can only touch on the highlights of the over 4000 enrollment and ethnic forecasts which comprised the entire study. Let us consider first those schools which might possibly be closed, either temporarily or permanently, for lack of sufficient enrollment. Of the 41 elementary schools, only five are projected to experience a loss of enrollment in 1990 relative to 1980. And only one of these five schools will undergo a decrease of more than 5%, McKinley which is expected to lose 10%. Schools such as Arlington,Lyon,McCarver,Park Avenue and Skyline are expected to drop somewhat in the early 80's but will recover in the last half of the decade.

In the junior high schools, the story is similar. Of the ten junior high schools, only three are expected to lose population, but the losses will be less than 4% over the decade. One school, Hunt, is forecasted to lose heavily (16%) in the next five years, but to regain the loss completely by 1990.

In contrast to the elementary and the junior high schools, the picture in the high schools will be on the pessimistic side. Of the five city high schools, all but one are forecasted to lose students over the decade. However, the losses for three of these are less than 7%, while the worst case,Foss, is projected to decrease by 15% by 1990.

Considering the question of which schools will significantly increase over the next decade, eleven elementary schools out of 41 are projected to grow by more than 20%. Of

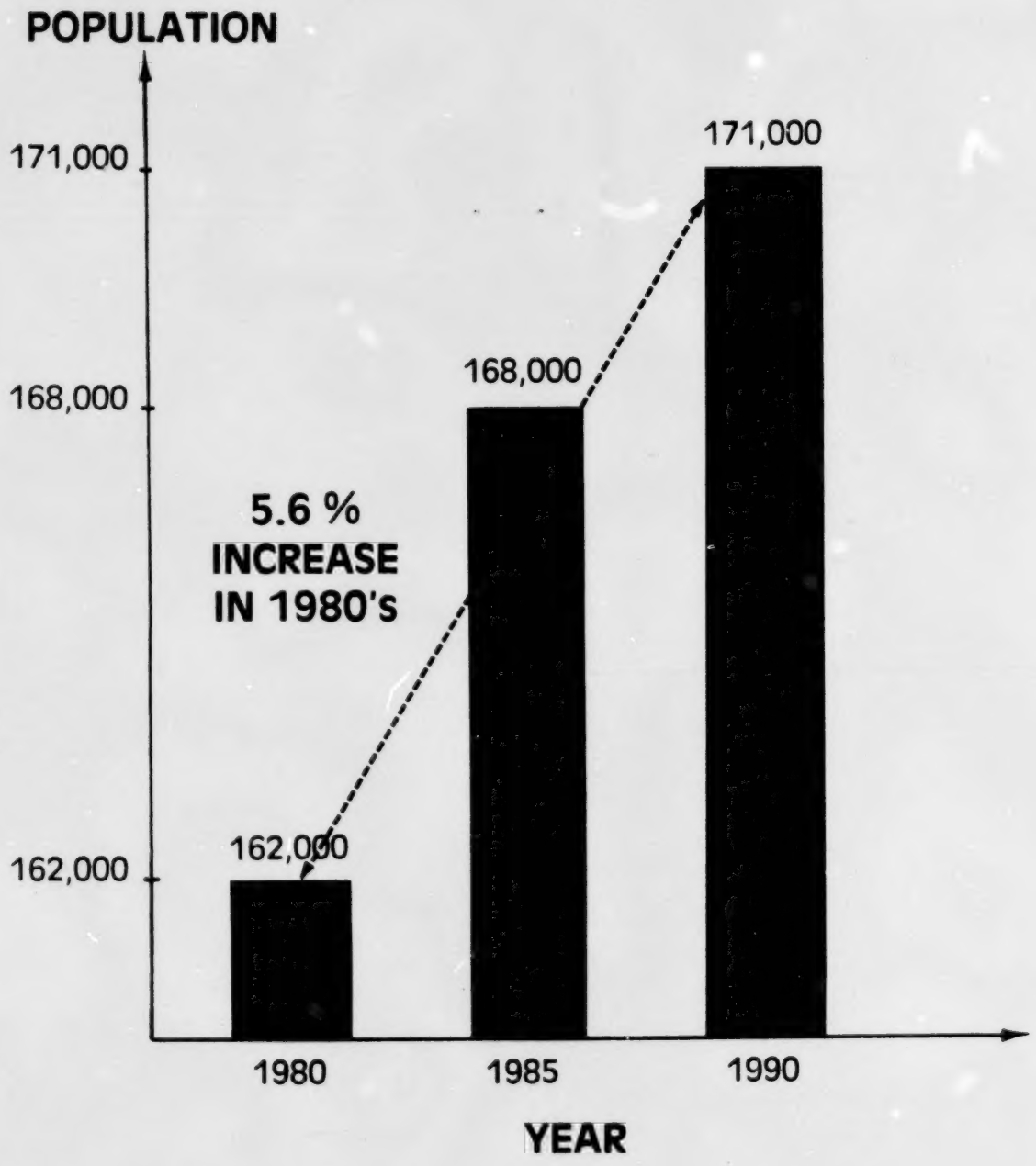
these, two schools, Browns Point-Dash Point and N.E. Tacoma are projected to increase by 79% and 156%, respectively.

Significant growth in the Junior high schools will be experienced by only one school, Meeker, over the next decade. Meeker's growth is projected at 212% raising their enrollment from 272 to 849 pupils. The six other Junior high schools projected to grow in the next decade will all gain by less than 11%.

Finally, considering the high schools, only one high school, Stadium, is projected to significantly gain pupils in the 80's. Stadium is expected to grow by 34.6% by 1990, increasing from 1100 to 1500 pupils over the decade. This forecast assumes that nearly all Northeast Tacoma pupils are fed into stadium High, as they are currently, and that the planned 3444 housing units in the Northeast will be occupied by 1990.

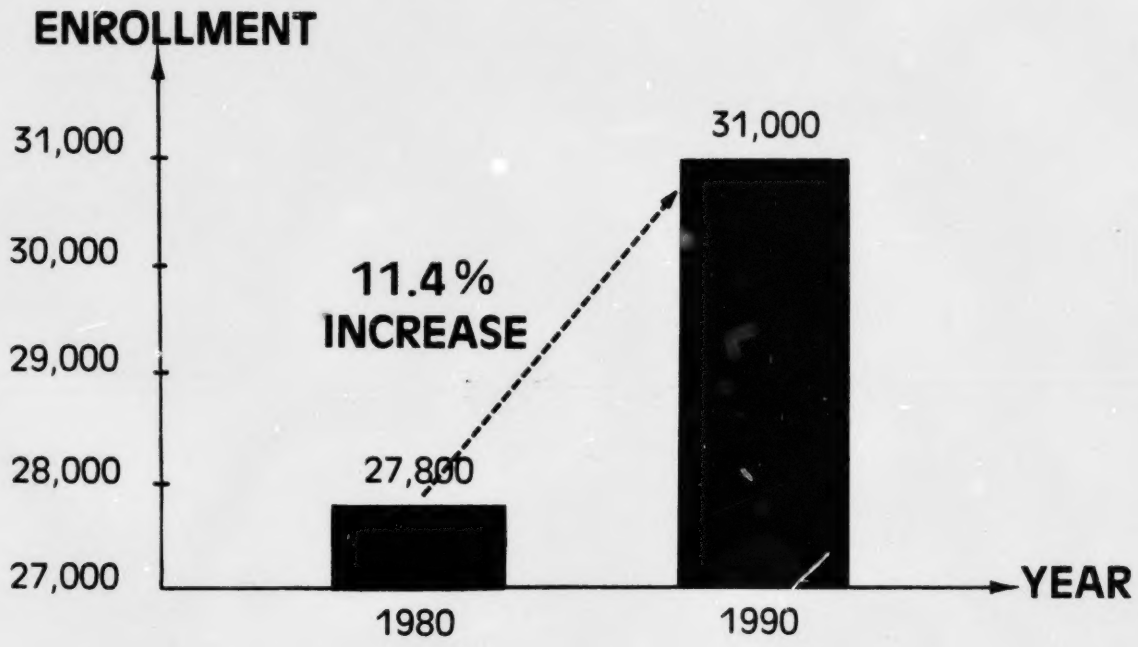
> CONCLUSION <

The 1980's will witness a turnaround in the declining enrollment of the Tacoma public schools. The projected economic growth of the Pierce County-Tacoma area will attract families to the city. Moreover, the steady increases in both the fertility rate and the number of women in the child-bearing age group will cause a continuation of a baby boomlet that Tacoma has already been seeing for the past five years. Barring any large-scale natural or man-made disasters, the District should not be faced with school closure problems that have plagued many other metropolitan areas. On the contrary, the District can look forward to stability or gradual growth in most of its schools, with sizable growth and its associated problems in the Northeast.



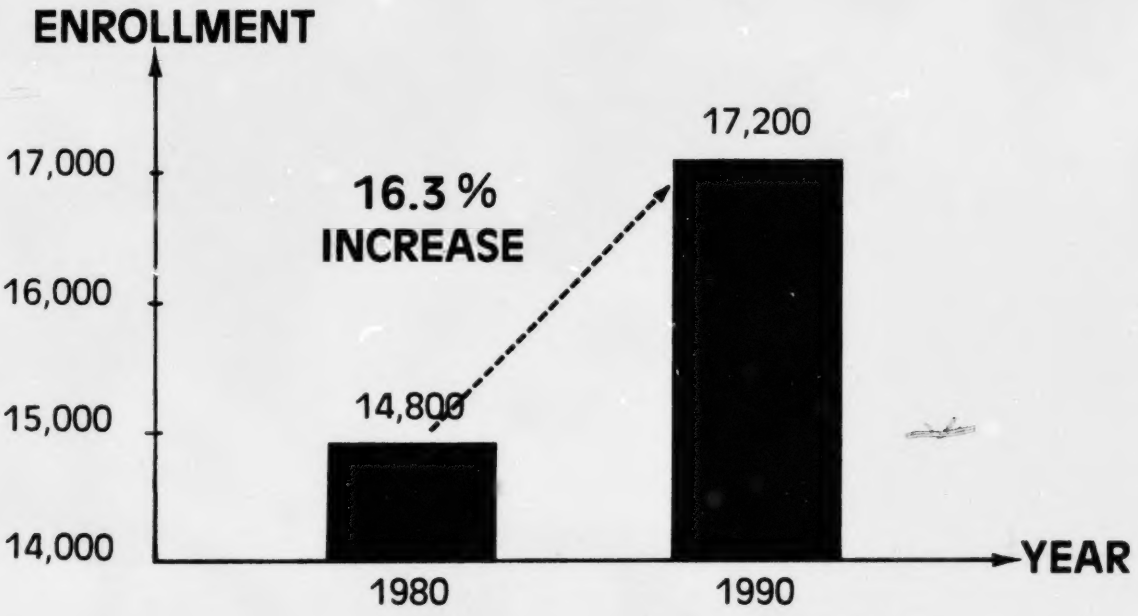
TACOMA'S POPULATION GROWTH

Fig. 1



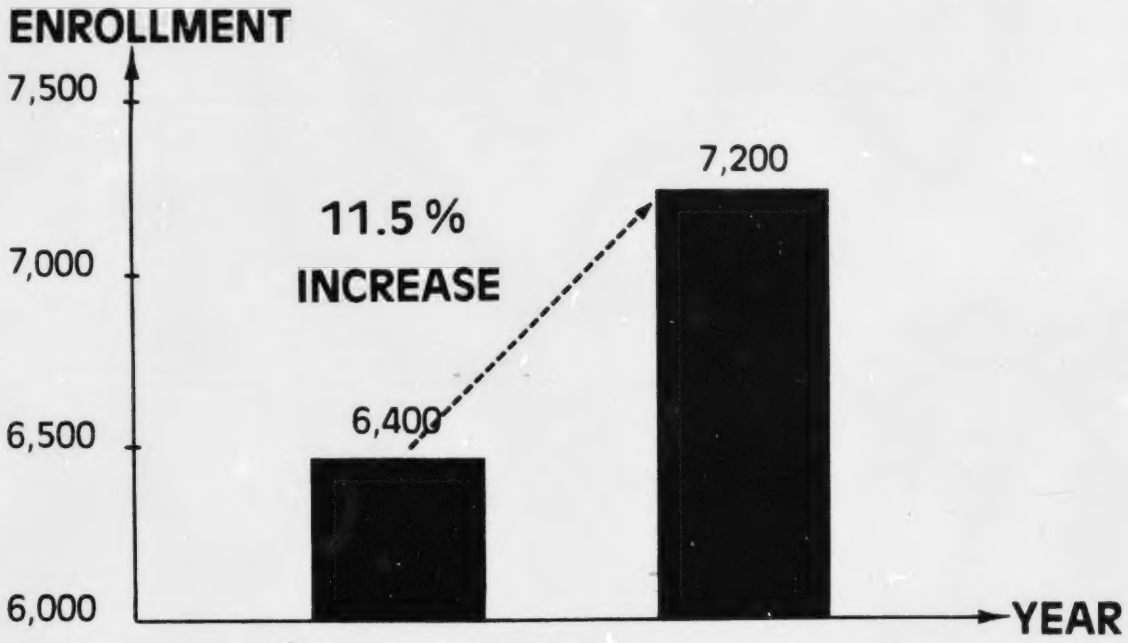
TOTAL TACOMA PUBLIC SCHOOL PUPILS

Fig. 2



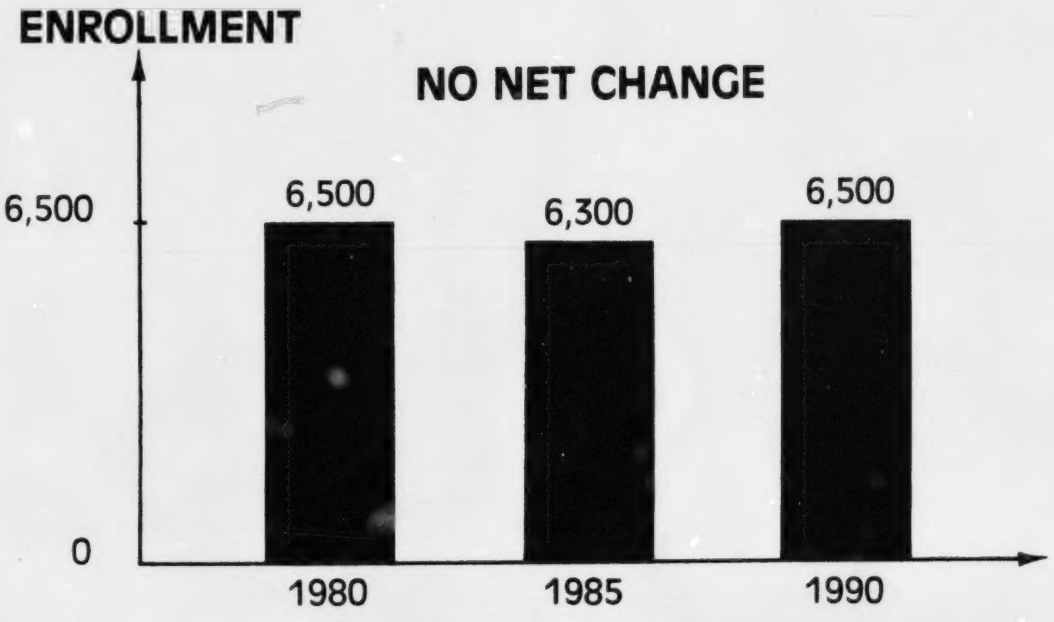
ELEMENTARY SCHOOL ENROLLMENT

Fig. 3



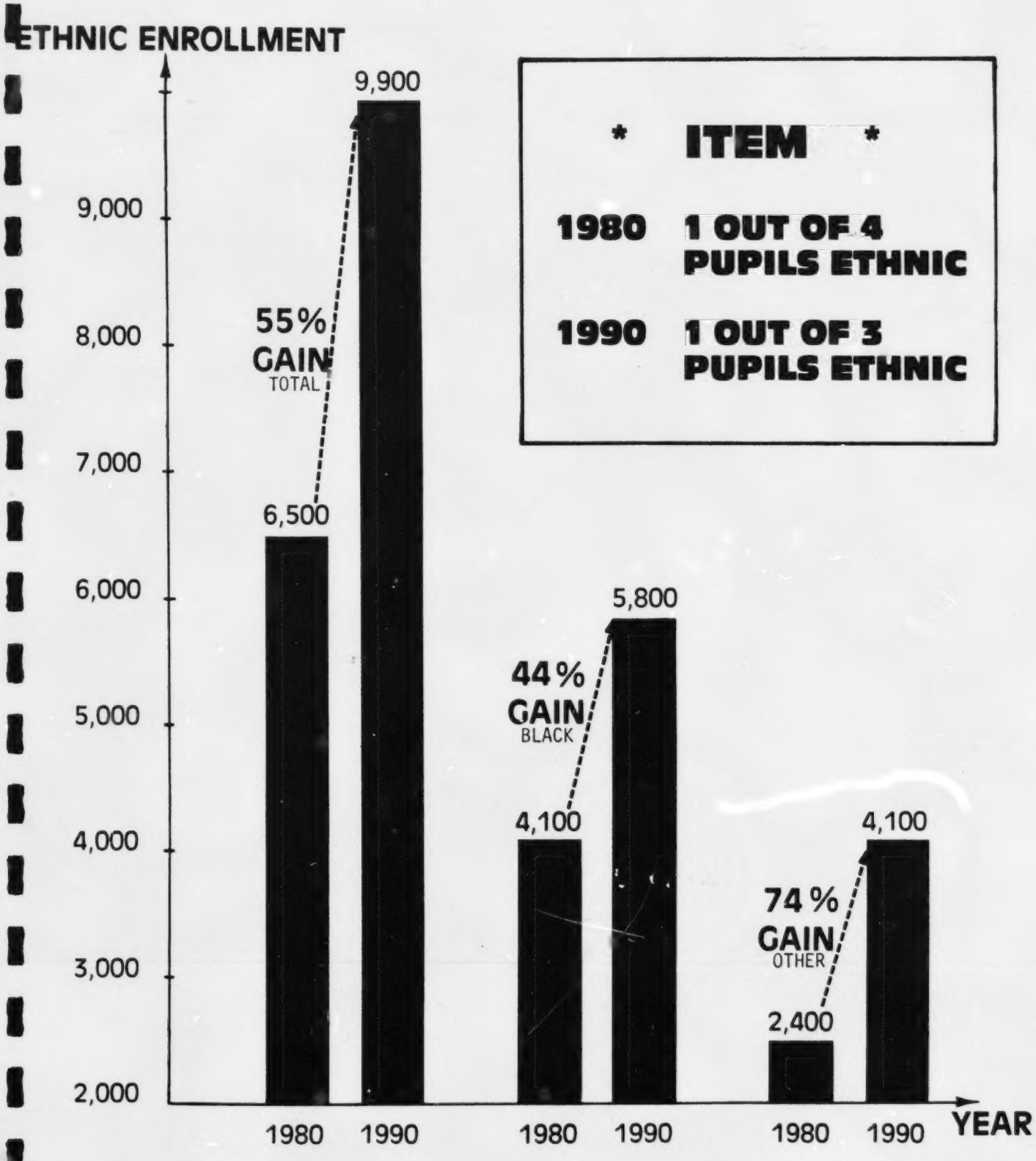
JR. HIGH SCHOOL ENROLLMENT

Fig. 4



SR. HIGH SCHOOL ENROLLMENT

Fig. 5 11



TOTAL, BLACK & OTHER ETHNIC ENROLLMENT

Fig. 6

TACOMA-PIERCE COUNTY IN THE 1980'S

> PURPOSE <

The purpose of this part of the forecast is to project a selected number of local area trends from 1980 to 1990. These projections are then used to create a "surprise free" future for Tacoma-Pierce County. A "surprise free" future is one in which the past trends are projected to develop along the most likely path. All long-term major system shocks such as devasting natural disasters (e.g., earthquakes, volcanos, floods, etc.) or man-made catastrophes (e.g., nuclear war, revolution, biological-chemical accident) are ruled out in the surprise free forecast.

It is also the intention of this part of the forecast to provide the Tacoma School Board and the top district administrators with a broad picture of the future of the area in which the district is situated. The individual school forecasts will have more meaning if they are understood within a context of a city-county future which addresses issues related to the economy, employment, housing and demographic factors.

> THE TRENDS <

Eight trends were selected from among twenty-four collected by the Tacoma Department of Community Development. They were selected by two professionals in futures/forecasting on the basis of judgement plus discussions. The trends are:

1. Population of Tacoma
2. Population of Pierce County
3. Population of Washington State
4. Non-agriculture wage and salary employees in Pierce County
5. Personal income per capita in Pierce County
6. Persons per household in Pierce County
7. Taxable retail sales in Pierce County
8. Tacoma building permits in dollar amount and in numbers of permits.

> POPULATION <

In 1978 the population of Tacoma was 158,000. It is projected to rise to 162,000 by 1980; 168,000 by 1985; and 171,000 by 1990. These projections are high enough to account for the planned 3444 new housing units in Northeast Tacoma which would add by 1990 about 9800 more people assuming 2.85 persons per housing unit, the present PPH figure in that section of the city.

The Tacoma population projection implies that the city will

be growing by 5.6% in the eighties as contrasted to 5.2% in the seventies.

The Pierce County population, on the other hand, is experiencing a much more rapid growth. Pierce County went from 412,000 people in 1970 to 457,000 (estimated) in 1980. By 1990, Pierce County is expected to be at 526,000. This means that although the county grew at a reasonably fast rate of 14.5% in the seventies, it is expected to continue to grow even more rapidly at 15.2% in the eighties.

The relationship between city, county and state population is always a matter of interest. In 1975, the city accounted for 4.5% of the state's population. By 1980 this ratio will fall to 4.1%, and to 3.8% by 1990. On the other hand, the county will hold its own at 12% of the state's population throughout the eighties, the same percentage as in the seventies.

The implications of these percentages are clear. State monies, such as basic education funds, which are allocated upon head count, will see the city getting a diminishing fraction but the county holding its fraction constant. Budget and hence levy and bond issue questions will all be affected by these population figures.

> HOUSING <

The number of new housing units to be built in Pierce County in the coming decade was projected on the basis of two separate trends:

1. The population forecast of Pierce County, and
2. The projected number of persons per household in Pierce County, referred to as the PPH.

The PPH was projected in two ways: a low way resulting from combining three past trend forecasts plus a judgemental forecast; and a high way using only one judgemental method. The low way has PPH declining from 2.6 in 1980 to 2.2 in 1990. The high way assumes PPH will remain constant at the 1980 level of about 2.7. A strong argument exists for holding PPH constant over the next decade. In the last four years both the city and county have experienced what amounts to the beginning of a baby boom, with the birth rate increasing more than 10% for the city and 12% for the county. Other arguments elsewhere in this report add to the judgement of holding PPH constant. (See the section on Assumptions and Methodology, subsection on Population per Housing Unit.)

If the lower PPH figures are used, the number of new housing units needed in Pierce County by 1990 will be 74,000 or an average of 6,200 units per year. This represents an implausible 45% increase in housing stock over the next ten years. With interest rates high, it is not likely that this scenario will be realized.

A more likely scenario is obtained assuming a constant PPH of 2.7 persons per household. This assumption yields a 30,000 increase in the numbers of new housing units in the eighties or 2,500 new units per year on the average. Note that in 1979, a record year for housing, there were 3,200 building permits issued in Tacoma alone. Thus the industry is well able to meet the low demand projection, which would mean the housing stock of Pierce County is projected to increase by a manageable 18% in the eighties.

The cost of housing is another important variable. It is possible to calculate the cost of a unit relative to the average household income. In 1970, the average new unit cost was 10% more than the annual family income. By 1975, this figure had risen to 60%. According to projections, by 1985 we are looking at between 60 and 80% more and by 1990, 70% to 110% more than the average annual income per household.

Therefore, relative to the average family income, the cost of housing will have almost doubled from 1970 to 1990. In dollar terms, in 1970 a typical family earned $12,500 per year and a unit cost $13,400 to build, according to building permit figures for that year. By 1990, a typical family is projected to earn between $29,000 and $36,000 per year but the average home will cost $61,000 to build. The conclusion is inescapable: it will become increasingly difficult for young couples to buy their own homes. If a couple is considering owning their own home, they should buy now rather than wait until later.

> INCOMES <

On a per capita basis, income is projected to increase from $7,100 per person in 1978, to $8,200 in 1980, $10,700 in 1985, and finally to $13,400 in 1990. In terms of the typical household, this means an increase in family income from 53% to 89% depending on whether there are 2.2 or 2.7 persons per household, respectively. The average family, therefore, can expect to be earning by 1990 from one and a half to twice as much as it earned last year.

> RETAIL SALES <

How we will use our incomes can be glimpsed by projecting retail sales and then comparing the figures to changes in population. For Pierce County the retail sales per person are expected to increase from $5,200 per year in 1980 to $9,600 by 1990, a gain of 86%. All calculations are in current, inflated dollars. In terms of the percentage of income spent on retail sales, the average household, which spent 59% on their total income on retail sales in 1975, will spend 66% by 1990. This implies more relative consumption and less relative savings. It also implies

increased consumer credit notwithstanding high interest rates.

> EMPLOYMENT <

Lastly, employment in Pierce County is projected over the next decade and for various economic sectors. The forecast considers only non-agricultural wage and salary employment, excluding the military.

In 1978 there were 134,000 persons employed in Pierce County. By 1980, this figure is estimated to increase to 139,000; by 1985 to 156,000; and by 1990, 174,000. Put another way, Pierce County's public and private sectors will have to create 35,000 new jobs in the 1980's, or 3,500 new jobs per year. That means a 25% increase in jobs in the coming decade, relative to a 15% increase in population. It should be noted that such an increase, high as it is in jobs, was exceeded on a percentage basis in the seventies. In the last decade, the number of jobs increased by 31% while the population grew by only 14.5%.

How can such a difference between job increases and population increases be explained? The explanation lies in the increase in the female work force, which has been called the most revolutionary trend in our society in this century. In Pierce County, from 1975 to 1985 the percentage of all women in the labor force is projected to increase from 41% to 46%; for women 30-40 years of age, it is projected to go from 55% to 65%.

Proceeding further, a matter of some interest to educators should be which sectors of the economy will the growth in jobs occur in the eighties. The big gainers will be the services, increasing 45%, and wholesale and retail trade, increasing 33%. Moderate gains will be experienced in government and education, 25%; in finance/insurance/real estate, 25%; and in contract construction, 16%. Zero gain will be in manufacturing and transportation/communications/public utilities.

> SUMMARY OF PROJECTIONS <

To sum up the picture of Tacoma-Pierce County on the basis of these projections, the following could be said:

1. Both the city and county will grow in population, but the county will grow nearly three times as fast as the city.

2. Incomes will grow, but housing costs will grow even faster, stimulated by the ever-growing demand of a growing population.

3. Retail sales will consume a steadily increasing share of the family income resulting in relatively less savings per family and higher debt levels.

4. Employment will grow twice as fast as population; it will absorb increasing percentages of women. By the end of the decade there will be almost a third as many new jobs as there are now. The services and trade will be the sectors of the largest employment gain.

Each of these trends that have been forecasted has hidden costs as well as obvious benefits. For example, more people mean more demand for public schools, improved sewers, roads and social services, as well as more retail sales. More people mean an increased need for high quality management in the public sector as well as new job opportunities in the private sector. Thus, although Tacoma-Pierce County appears to be in for continued growth, citizens should be aware of the problems that accompany that growth. Especially important will be the need for public officials to be able to use trend forecasts such as these to anticipate the problems they will be faced with several years down the road and to take steps now to prevent those problems from becoming crises.

> PROCEDURE FOR MAKING AREA FORECASTS <

The population forecast of Pierce County was done in nine separate ways and averaged for the years 1980, 1985 and 1990. The population of Washington State was done in five ways. The remaining six trends were done in four ways each. These four ways included three mathematical methods (straight line, exponential and logarithmic) and one group judgemental method.

For the county population forecasts, three additional models were developed that assumed population depended upon increases in employment, i.e. jobs attract people to the area. Where they were available, OFM (Washington State Office of Financial Management) and COG (Puget Sound Council of Governments) forecasts were averaged in with the forecasts produced by the previously mentioned four methods.

> ESTIMATE OF UNCERTAINTY <

For each of the calculated and judgemental forecasts, an uncertainty estimate was calculated for the target years using a retrospective forecasting technique (predicting the present from the past and seeing how accurate is the forecast method). The range of uncertainty was between 5% and 10% for all trends in 1985 except for building permit amounts which was 27%. For 1990, the uncertainty estimates could only be calculated for population and employment trends and these ranged from 6% to 10%.

TOTAL ENROLLMENT FORECASTS BY SCHOOL

> ELEMENTARY SCHOOLS <

Of the 41 elementary schools in the district, only five show a loss of pupils over the entire 10 year period and only one of these has a loss greater than 10%. These five, together with their percent losses in parentheses, are Park Avenue (-1.9%), Arlington (-4.3%), McCarver (-4.5%), Lyon (-4.9%), and McKinley (-10%).

On the other hand, eleven elementary schools exhibit a marked gain in pupils over the next decade. These can be divided up into three groups. The first group, consisting of seven schools, will increase by about 20% over the period. These are:

Oakland	19.8%
Wainwright	20.2%
Whittier	20.5%
Birney	20.9%
Boze	21.6%
Rogers	22.2%
Manitou	22.9%

The second group, consisting of two schools, will increase by more than 30% over the decade. They are Bryant (31.9%) and Geiger (38.2%).

Finally, a third group, also consisting of two schools, will experience a tremendous growth in the 1980's. These are the two elementary schools located in Northeast Tacoma, Browns Point-Dash Point which will grow by 79% and N.E. Tacoma by 156%.

A complete list of all 41 elementary schools together with their rates of growth in the first half, the second half and over the entire decade is shown in Table 1. The projected number of pupils for each elementary school for the years 1980,85 and 90 is shown in Table 2.

It should be noted that ten schools are forecasted to decrease in enrollment over the 1980 to 85 period, but then to recover either partially or fully by 1990. These are, together with their losses in the first five years:

Willard	-1.2%
Jefferson	-1.8%
Fern Hill	-4.4%
Whitman	-4.6%
Lowell	-5.9%
Skyline	-7.5%
Arlington	-8.5%
Lyon	-9.0%

McKinley	-12.1%

Only in McKinley will the eventual loss at the end of the decade amount to more than five percent.

> JUNIOR HIGH SCHOOLS <

Of the ten junior high schools, three are projected to experience losses over the 1980-1990 period. In no case will any school's loss be greater than 4%. These three schools and their expected losses are:

Gault	-1.0
Jason Lee	-3.8%
Stewart	-4.0%

Conversely, seven junior high schools are forecasted to increase in enrollment over the decade. Of these, three will show gains of less than five percent:

Hunt	0.7%
Baker	3.9%
Gray	4.1%

Three more schools will show gains between 8% and 11%:

Mason	8.3%
Truman	9.3%
McIlvaigh	10.9%

Finally one school will undergo extraordinary growth in the 80's. Meeker Junior High in the Northeast is projected to grow by 212% from 272 pupils in 1980 to 849 pupils by 1990.

The Meeker forecast is based on the assumption that all currently planned 3444 housing units in Northeast Tacoma are constructed and occupied by the end of the decade. Most of Meeker's growth will take place in the first half of the decade during which time enrollment will increase from 272 to 623 or by nearly 130%. The last half of the decade sees slower growth for Meeker, going from 623 to 849 pupils or by 36%. If interest rates remain at their high current level and demand for new housing continues to be low, the enrollment growth in 1980-1985 period will be less than forecasted. In that event, the larger increase in enrollment could occur in the 1985-1990 period when housing demand returns to the pre-1980 levels.

Percentage changes for junior high school enrollment for the first half, the second half and for the entire decade of the 80's are shown in Table 3. The projected enrollments in numbers of pupils for 1980, 85 and 90 are shown in Table 4.

> SENIOR HIGH SCHOOLS <

In contrast to the elementary and junior high schools, the majority of senior high schools will experience a decline in enrollment in the next decade. Four out of five of the high schools will see a drop in enrollment from 1980 to 1990. But in three of these four the decline will be less than 8%; in the fourth the decline will be about 15%.

The high schools which will experience relatively small declines in enrollment are:

Mt. Tahoma	-3.3%
Wilson	-5.6%
Lincoln	-7.2%

The only high school to experience a sizable decrease in enrollment will be Foss which will lose 14.8% or about 150 pupils over ten years.

In stark contrast to these four high schools will be Stadium High, which receives practically all of Meeker Junior High pupils. Projections show that Stadium should increase from 1137 to 1530 pupils or by nearly 35% in the coming decade. These projections assume that the current patterns of allocating junior high students to senior highs will continue into the future.

The percentage changes and the numbers of pupils enrolled in the senior high schools are shown in Tables 5 and 6.

> TOTAL PUBLIC SCHOOL ENROLLMENT <

In the next decade, the elementary schools are projected to grow by 16%, at a rate somewhat less than 8% in the 1980-1985 period and somewhat greater than 8% in the 1985-1990 period. In numbers of pupils, the elementary schools will increase from 14,765 to 17,178 for a net gain of 2413 pupils.

The junior high schools are forecasted to grow at a more moderate rate of 11.5%. They will increase about twice as fast in the 1985-1990 period as in the 1980-1985 period. In terms of numbers, the junior highs will increase from 6436 to 7137 pupils or a net gain of 701 pupils over the ten year period.

The high schools will grow hardly at all in the next decade. In the first five years they will lose 2.8% of their enrollment but gain it back in the second half of the decade. In short, the high schools are projected to remain at or slightly below the present figure of 6580 pupils.

The combined total enrollment of the Tacoma schools will increase by about 11% over the the next decade. The largest amount

of that increase will occur in the second half of the decade. In terms of pupils, the enrollments are projected to increase from about 27,800 in 1980 to 28,800 in 1985 to over 30,900 in 1990. Overall, we are looking at a net gain of approximately 1000 pupils in the first five years, 2000 pupils in the next five, making over 3000 pupils in the entire decade.

The percentage changes in enrollments and projected numbers of pupils are shown for the district in Tables 7 and 8, respectively.

TABLE 1

PERCENTAGE CHANGES IN ELEMENTARY SCHOOL ENROLLMENTS

SCHOOL NAME	1980-1985	1985-1990	1980-1990
ARLINGTON	-8.5	4.7	-4.3
BIRNEY	11.9	8.1	20.9
BOZE	8.9	11.7	21.6
BP-DP	44.4	24	79.1
BRYANT	5.7	7.9	14.1
DELONG	25.8	4.9	31.9
DOWNING	1.3	5.4	6.8
EDISON	6.9	3.7	10.8
FAWCETT	-1.4	5.3	3.8
FERN HILL	-4.4	9	4.2
FRANKLIN	4	2.5	6.5
GEIGER	25	10.5	38.2
GRANT	10.2	6.2	17
HOYT-WASH	1.8	10.7	12.8
JEFFERSON	-1.8	2	.2
LARCHMONT	10	6.3	17
LISTER	7.7	5	13.1
LOWELL	-5.9	8.5	2.1
LYON	-9	4.5	-4.9
MADISON	1.9	7.8	9.8
MANITOU	12.3	9.4	22.9
MANN	8.4	9.5	18.7
MCCARVER	-9.4	5.4	-4.5
MCKINLEY	-12.1	2.4	-10
N.E.TACOMA	86.9	37	156.1
OAKLAND	5.7	13.3	19.8
PARK AVE.	-8.3	7	-1.9
PT. DEFIANCE	3.2	10.4	14
REED	0	7.8	7.8
ROGERS	13.5	7.7	22.2
ROOSEVELT	8.7	-.7	7.9
RUSTON	11.2	3.8	15.4
SEWARD	6.8	8.1	15.5
SHERIDAN	.9	6.6	7.6
SHERMAN	9.8	8.5	19.1
STANLEY	8.5	3.6	12.4
SKYLINE	-7.5	11.2	2.9
WAINWRIGHT	9.4	9.8	20.2
WHITMAN	-4.6	6.7	1.8
WHITTIER	10.6	9	20.5
WILLARD	-1.2	6.1	4.8

TABLE 2

PROJECTED ENROLLMENTS IN TACOMA ELEMENTARY SCHOOLS

SCHOOL NAME	1980	1985	1990
ARLINGTON	282	258	270
BIRNEY	354	396	428
BOZE	449	489	546
BP-DP	340	491	609
BRYANT	262	277	299
DELONG	295	371	389
DOWNING	473	479	505
EDISON	305	326	338
FAWCETT	366	361	380
FERN HILL	501	479	522
FRANKLIN	428	445	456
GEIGER	296	370	409
GRANT	394	434	461
HOYT-WASH	329	335	371
JEFFERSON	497	488	498
LARCHMONT	330	363	386
LISTER	443	477	501
LOWELL	389	366	397
LYON	268	244	255
MADISON	215	219	236
MANITOU	397	446	488
MANN	427	463	507
MCCARVER	595	539	568
MCKINLEY	380	334	342
N.E.TACOMA	419	783	1073
OAKLAND	192	203	230
PARK AVE.	313	287	307
PT. DEFIANCE	344	355	392
REED	244	244	263
ROGERS	334	379	408
ROOSEVELT	252	274	272
RUSTON	143	159	165
SEWARD	219	234	253
SHERIDAN	450	454	484
SHERMAN	482	529	574
STANLEY	591	641	664
SKYLINE	483	447	497
WAINWRIGHT	362	396	435
WHITMAN	452	431	460
WHITTIER	303	335	365
WILLARD	167	165	175

TABLE 3

PERCENTAGE CHANGES IN JUNIOR HIGH SCHOOL ENROLLMENTS

SCHOOL NAME	1980-1985	1985-1990	1980-1990
BAKER	1.5	2.4	3.9
CAULT	-.4	-.6	-1
GRAY	2.2	1.9	4.1
HUNT	-16	19.9	.7
JASON LEE	-4.5	.7	-3.8
MASON	-.2	8.4	8.3
MCILVAIGH	9	1.7	10.9
MEEKER	129	36.3	212.1
STEWART	-3	-1.1	-4
TRUMAN	2.6	6.5	9.3

TABLE 4

PROJECTED ENROLLMENTS IN TACOMA JUNIOR HIGH SCHOOLS

SCHOOL NAME	1980	1985	1990
BAKER	738	749	767
CAULT	486	484	481
GRAY	558	570	581
HUNT	977	821	984
JASON LEE	718	686	691
MASON	666	665	721
MCILVAIGH	423	461	469
MEEKER	272	623	849
STEWART	875	849	840
TRUMAN	723	742	790

TABLE 5

PERCENTAGE CHANGES IN SENIOR HIGH SCHOOL ENROLLMENTS

SCHOOL NAME	1980-1985	1985-1990	1980-1990
FOSS	-16.3	1.8	-14.8
LINCOLN	-4.5	-2.9	-7.2
MT. TAHOMA	-3.4	.1	-3.3
STADIUM	14.6	17.4	34.6
WILSON	-4.8	-.8	-5.6

TABLE 6

PROJECTED ENROLLMENTS IN THE TACOMA SENIOR HIGH SCHOOLS

SCHOOL NAME	1980	1985	1990
FOSS	993	831	846
LINCOLN	1385	1323	1285
MT. TAHOMA	1324	1279	1280
STADIUM	1137	1303	1530
WILSON	1741	1657	1643

TABLE 7

PERCENTAGE CHANGES IN ENROLLMENTS

	1980-1985	1985-1990	1980-1990
ELEMENTARY	6.8	9.0	16.3
JUNIOR HIGH	3.3	7.9	11.5
SENIOR HIGH	-2.8	3.0	0.1
TOTAL SCHOOL	3.7	7.4	11.4

TABLE 8

PROJECTED SCHOOL ENROLLMENTS

	1980	1985	1990
ELEMENTARY	14,765	15,766	17,178
JUNIOR HIGH	6,436	6,650	7,137
SENIOR HIGH	6,580	6,393	6,584
TOTAL SCHOOL	27,781	28,809	30,935

ETHNIC ENROLLMENT FORECASTS BY SCHOOL

> INTRODUCTION <

The primary purpose of this section is to inform the reader concerning the broad trends in ethnic enrollments in the Tacoma Public Schools. The secondary purpose is to call attention to those schools which may reach or exceed ethnic percentage limit guidelines in the next decade.

Ethnic enrollment forecasts consist of forecasts of the percentages of Black pupils, Other Ethnic pupils (Asians, Hispanic and Native American), and total ethnic enrollment for the period 1980-1990. No breakdown of the Other Ethnic category was attempted in this study.

The percentage forecasts for each school were obtained by combining the judgemental forecasts of school principals and their staffs with the trend forecasts from the computer. Individual school forecasts were then totaled and compared to district ethnic forecasts. Differences were reconciled by proportionally adjusting the individual school forecasts so that, when summed up, their total equaled the district forecast for the particular ethnic category (Black or Total Ethnic).

This section will first treat Black pupil enrollments in the three school levels, elementary, junior high and senior high. It will then proceed to discuss which individual schools are approaching guideline limits. Other Ethnic and total ethnic enrollments will respectively be treated according to a similar procedure.

> BLACK PUPIL ENROLLMENTS <

Black pupil enrollments are projected to increase from 14.5% of total district enrollment in 1980, to 16.6% by 1985, and to nearly 19% by 1990. For the elementary and junior high schools, the gain will be slightly less, going from somewhat more than 14% in 1980 to about 18% in 1990. In the senior high schools, the gain will be a bit more, increasing from over 14% to nearly 21% by 1990.

In terms of numbers of Black pupils, the elementary schools are projected to increase by nearly 1000 Black children over the decade. Both the junior and senior high schools are projected to increase by approximately 400 Black pupils by 1990. Altogether, the district will have 1800 more Black pupils by the end of the decade than it had in the beginning.

Looking at which schools will have reached the upper limit

guideline of 40% for Black pupils by 1990, the forecast indicates three elementary and one junior high school. These schools, together with the year in which they are projected to reach the 40% Black limit, are:

Bryant Elementary	1980
Stanley Elementary	1980
McIlvaigh Jr. High	1984
Wainwright Elementary	1988

A number of schools are projected to be approaching the 40% limit by 1990. These, together with their projected percentages of Black pupils, are:

McCarver Elementary	34.9%
Jason Lee Jr. High	36.1%
Boze Elementary	37.4%
Lister Elementary	37.8%
Rogers Elementary	38.6%

A complete list of Tacoma district schools with their projected Black percentages for 1980, 1985 and 1990 is shown in Table 9. Table 12 shows the Black percentages by level of school, i.e., elementary, junior high and senior high, plus total district percentages for 1980, 1885 and 1990. In Table 15 projected numbers of Black pupils for the three levels and total are given for the same three years.

***> OTHER ETHNIC ENROLLMENT ***<

Other Ethnic enrollment in the Tacoma public schools will increase at a far higher rate than Black pupil enrollment. This phenomenon is a continuation of a trend begun in the 1970's. Overall, the Other Ethnics will increase from 8.5% to nearly 13% of the total enrollment by the end of the decade. In terms of numbers, the increase in Other Ethnics will nearly equal the increase in Black pupils over the same period, i.e., a gain of 1650 Other Ethnics as opposed to a gain of 1800 Black pupils. Whereas in 1980, there are 2350 Other Ethnics, by 1990 there will be 4000 Other Ethnics in the schools. That is, by 1990, over 1 out of 8 pupils will be either Asian, Hispanic or Native American in the Tacoma public schools.

Looking at the three levels of schools, the elementary schools will see the percentage of Other Ethnics go from 9% to nearly 13% over the decade; the junior high schools from 8% to 12.6%; and the senior highs from 7.5% to nearly 14%. In terms of numbers, the elementary schools are expected to gain 850 Other Ethnics, and the junior and senior high schools approximately 400 Other Ethnic pupils by 1990.

Although no subgroup within the category of Other Ethnic approaches anywhere near the 40% guideline limit, it is still

interesting to focus on those schools which will have relatively high Other Ethnic enrollment by the end of the decade. Examining the projections for 1990, it is seen that one elementary school will exceed 30% in Other Ethnic enrollment, namely Fern Hill with 31.5%. Furthermore, ten other elementary schools are forecasted to have between 19% and 30% Other Ethnics by 1990. These schools, together with their Other Ethnic percentages are:

Oakland	19.2%
Reed	19.3%
Edison	19.4%
Seward	19.9%
Roosevelt	20.6%
Willard	22.4%
Sheridan	23.4%
Larchmont	24.2%
Franklin	25.6%
Birney	26.6%

In the higher grade levels, two junior high schools and two senior high schools are projected to have between 19% and 30% Other Ethnics by 1990:

Baker	26.5%
Gault	28.3%
Lincoln	19.8%
Mt. Tahoma	21.4%

To summarize, out of the 56 schools in the district, fully 15 or better than 1 out of 4 will have sizable Other Ethnic enrollments by 1990 if present trends continue. It should be noted that in the 1970's, the United States took in an average of 430,000 immigrants per year, 82% of whom originated from Latin America and Asia. Moreover, if the rate of political refugee immigration from Indo-China, Cuba or other third world countries increases, then the district will see even higher numbers of Other Ethnics in the 1980's.

The reader is referred to Table 10 for a list of public schools along with their Other Ethnic percentages in 1980, 1985 and 1990. For data on the three levels of schools plus the district, see Table 13 for percentages of Other Ethnics and Table 16 for numbers of pupils.

> TOTAL ETHNIC ENROLLMENTS <

The total ethnic enrollment in the public schools is the sum of the Black plus the Other Ethnic enrollment. For the district as a whole, the total ethnic enrollment is projected to increase from 23% in 1980 to nearly 32% in 1990. In other words, whereas in 1980 1 out of 4 pupils in the system is ethnic, by 1990 that ratio will be 1 out of 3 pupils.

Proceeding to the three school levels, the elementary schools will see the total ethnics increase in percentage from 23.5% to nearly 31%. This results in an increase of 1800 pupils to reach a level in 1990 of nearly 5300 ethnic elementary pupils.

On the Junior high school level, the total ethnic enrollment will increase from 23% in 1980 to 31% in 1990. This implies a gain of about 760 ethnic pupils to eventually reach a total of 2200 by the end of the decade.

Finally, in the senior high schools, the ethnic percentage of the total enrollment will grow from 22% in 1980 to almost 35% by 1990, the largest percentage of all three levels. This represents a gain in ethnic pupils of over 840 to reach a level of nearly 2300 by 1990.

The total ethnic projections for each individual school permit the identification of those schools which will exceed the total ethnic guideline of 50%. Of the 41 elementary schools, nine will reach or exceed the guideline by 1990. These schools, together with their year of attaining 50% total ethnic, are:

Rogers	1983
Lister	1984
Bryant	1985
Willard	1985
Roosevelt	1986
Wainwright	1986
Boze	1988
Franklin	1988
Sheridan	1989
Stanley	1990

In addition, two Junior high schools are forecasted to reach the 50% ethnic limit in the 1980's. They are:

McIlvaigh	1983
Gault	1989

A number of other schools will reach between 40 and 49% total ethnic in the next decade. They are listed together with their percentage of enrollment that will be ethnic by 1990:

Madison Elementary	41%
Seward Elementary	42%
McCarver Elementary	46%
Baker Jr. High	40%
Jason Lee Jr. High	50%
Mt. Tahoma High	43%
Lincoln High	44%

The projected figures for total ethnic percentages by individual school are shown in Table 11. Tables 14 and 17 display the percentages and numbers of total ethnic pupils according to level of school and for the entire district.

> CONCLUSION <

Using the data in the previously mentioned tables, it is possible to arrive at some interesting conclusions regarding the future composition of the growth in pupils in the district. In terms of numbers of pupils, the enrollment of ethnics of all kinds will increase by 3400 pupils during the decade, starting from a 1980 base of 6400 and increasing to 9800 by the end of the decade. This increase of 3400 ethnic pupils is greater than the projected total increase of the entire district enrollment over the same period, i.e., 3150 pupils. Thus, it may be concluded that although the ethnic population will grow by 87% in the coming decade, the Caucasian population will decline by about 1%. In other words, the entire growth in the Tacoma School District enrollment will be due to the increase in the ethnic population.

It is important, however, to view these projections of ethnic and Caucasian enrollments in the perspective of the recent past decade. During the 1970's the total enrollment of the district decreased from about 37,000 in 1970 to 29,000 in 1979. At the same time, the past data show that the Caucasian population decreased by about 9000 pupils. Thus, the 8000 drop in enrollment in the district in the past decade is accounted for by a decrease in Caucasians of 9000 at the same time the ethnics increased by over 1000 pupils.

To sum up, although all of the enrollment growth in the next decade will be wholly caused by gains in ethnic pupils, the absolute number of Caucasian pupils will remain about the same, which is in stark contrast to the heavy Caucasian decline in the past decade. Furthermore, the increase in ethnic pupils in the 1980's will be far less than was the decrease in Caucasians in the 1970's.

TABLE 9

PROJECTED PERCENTAGES OF BLACK STUDENTS IN TACOMA PUBLIC SCHOOLS

SCHOOL NAME	1980	1985	1990
ARLINGTON	6.8	7.2	8.3
BIRNEY	11.9	14.9	17.9
BOZE	28.6	33.4	37.4
BP-DP	0	0	0
BRYANT	40	40	40
DELONG	16.7	18.2	20.8
DOWNING	6.2	8.4	11.1
EDISON	6.3	7.4	8.6
FAWCETT	6	7.1	8.2
FERN HILL	5.9	6.3	7
FRANKLIN	18	21.1	24.4
GEIGER	11.7	12.5	14.6
GRANT	5.2	6	6.6
HOYT-WASH	5.5	6.5	7.2
JEFFERSON	20.4	25.3	30.2
LARCHMONT	2.7	3	3.5
LISTER	31.9	35.5	37.8
LOWELL	8.3	10.6	13.8
LYON	6.5	9.4	12
MADISON	18.8	21.6	27.1
MANITOU	8.5	11.5	15
MANN	6.7	8	9.9
MCCARVER	32.2	33.3	34.9
MCKINLEY	13.9	18.7	23.7
N.E.TACOMA	2.6	3.7	5.2
OAKLAND	10.5	13.5	16.3
PARK AVE.	8.5	10.3	12.2
PT. DEFIANCE	5.9	7.8	9.9
REED	16.5	17.9	20.1
ROGERS	25.6	31.7	38.6
ROOSEVELT	28.7	29.6	29.4
RUSTON	6.4	6.8	7.2
SEWARD	16.3	18.6	22.1
SHERIDAN	22	24.4	26.6
SHERMAN	3.1	4	5.2
STANLEY	40	40	40
SKYLINE	10.2	12.6	16.3
WAINWRIGHT	28.8	38	40
WHITMAN	7.4	8.3	9.3
WHITTIER	6.4	7	7.7
WILLARD	19.8	22.1	27.6
BAKER	9.2	10.8	13
GAULT	18.3	19.8	21.7
GRAY	9.5	11.4	13.5
HUNT	17.7	22	27.1
JASON LEE	23.6	29.5	36.1
MASON	10.8	12.8	14.8
MCILVAIGH	33.8	40	40
MEEKER	2.4	1.9	1.9
STEWART	9.8	11.8	14
TRUMAN	9.6	10.3	11.4
FOSS	18.7	20.5	22.1
LINCOLN	18.6	22	24.5
MT.TAHOMA	13.1	17.1	21.9
STADIUM	10	12.9	15.7
WILSON	12.8	16.8	21.2

TABLE 10

PROJECTED PERCENTAGES OF OTHER ETHNIC STUDENTS IN TACOMA PUBLIC SCHOOLS

SCHOOL NAME	1980	1985	1990
ARLINGTON	6.2	8.2	10
BIRNEY	19.5	21	26.6
BOZE	9.1	12	12.6
BP-DP	4.1	5	6.4
BRYANT	6.2	10	10
DELONG	7.1	10.5	14.7
DOWNING	3.6	5.3	7.3
EDISON	15.4	17	19.4
FAWCETT	7.6	9.3	12.1
FERN HILL	16.9	23.6	31.5
FRANKLIN	16.6	23.6	25.6
GEIGER	6.8	11.5	15.2
GRANT	8	9.2	10.7
HOYT-WASH	4.4	5.6	6.3
JEFFERSON	3.1	4.2	5.6
LARCHMONT	13.6	18.7	24.2
LISTER	16.7	14.5	12.2
LOWELL	2	2.4	2.7
LYON	4.2	5.2	7
MADISON	9.7	10.8	13.4
MANITOU	6.1	9	12.2
MANN	6.6	9.2	11.4
MCCARVER	10.1	9.7	11
MCKINLEY	10.9	13.1	14.5
N.E.TACOMA	5.1	5.3	6
OAKLAND	11.9	14.9	19.2
PARK AVE.	5.1	6.8	8.3
PT. DEFIANCE	4.8	5.9	7.5
REED	17.2	17.6	19.3
ROGERS	21.2	18.3	11.4
ROOSEVELT	15.2	19.7	20.6
RUSTON	6.5	7	7.5
SEWARD	11.2	14.9	19.9
SHERIDAN	13.7	19.3	23.4
SHERMAN	4.5	5.7	7
STANLEY	4.6	7.6	10
SKYLINE	5.5	9	12.3
WAINWRIGHT	6.6	9.6	10
WHITMAN	4.9	5.5	6.5
WHITTIER	5.8	6.7	9
WILLARD	24.1	27.9	22.4
BAKER	14.2	20.3	26.5
GAULT	18.9	25.5	28.3
GRAY	6.5	7.1	8.4
HUNT	5.5	8	10.2
JASON LEE	10.2	13.2	13.6
MASON	4.1	5	6.4
MCILVAIGH	10.6	10	10
MEEKER	4.7	5.8	6.5
STEWART	5.9	7.8	10
TRUMAN	5.5	8.8	11.6
FOSS	7.4	11.2	16.2
LINCOLN	11	15.1	19.8
MT.TAHOMA	10.7	15.8	21.4
STADIUM	4.8	6.6	8.9
WILSON	4.1	5.4	7.1

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TABLE 11

PROJECTED PERCENTAGES OF TOTAL ETHNIC STUDENTS IN TACOMA PUBLIC SCHOOLS

SCHOOL NAME	1980	1985	1990
ARLINGTON	13	15.4	18.3
BIRNEY	31.4	35.9	44.5
BOZE	37.7	45.4	50
BP-DP	4.1	5	6.4
BRYANT	46.2	50	50
DELONG	23.8	28.7	35.5
DOWNING	9.8	13.7	18.4
EDISON	21.7	24.4	28
FAWCETT	13.6	16.4	20.3
FERN HILL	22.8	29.9	38.5
FRANKLIN	34.6	44.7	50
GEIGER	18.5	24	29.8
GRANT	13.2	15.2	17.3
HOYT-WASH	9.9	12.1	13.5
JEFFERSON	23.5	29.5	35.8
LARCHMONT	16.3	21.7	27.7
LISTER	48.6	50	50
LOWELL	10.3	13	16.5
LYON	10.7	14.6	19
MADISON	28.5	32.4	40.5
MANITOU	14.6	20.5	27.2
MANN	13.3	17.2	21.3
MCCARVER	42.3	43	45.9
MCKINLEY	24.8	31.8	38.2
N.E.TACOMA	7.7	9	11.2
OAKLAND	22.4	28.4	35.5
PARK AVE.	13.6	17.1	20.5
PT. DEFIANCE	10.7	13.7	17.4
REED	33.7	35.5	39.4
ROGERS	46.8	50	50
ROOSEVELT	43.9	49.3	50
RUSTON	12.9	13.8	14.7
SEWARD	27.5	33.5	42
SHERIDAN	35.7	43.7	50
SHERMAN	7.6	9.7	12.2
STANLEY	44.6	47.6	50
SKYLINE	15.7	21.6	28.6
WAINWRIGHT	35.4	47.6	50
WHITMAN	12.3	13.8	15.8
WHITTIER	12.2	13.7	16.7
WILLARD	43.9	50	50
BAKER	23.4	31.1	39.5
GAULT	37.2	45.3	50
GRAY	16	18.5	21.9
HUNT	23.2	30	37.3
JASON LEE	33.8	42.7	49.7
MASON	14.9	17.8	21.2
MCILVAIGH	44.4	50	50
MEEKER	7.1	7.7	8.4
STEWART	15.7	19.6	24
TRUMAN	15.1	19.1	23
FOSS	26.1	31.7	38.3
LINCOLN	29.6	37.1	44.3
MT.TAHOMA	23.8	32.9	43.3
STADIUM	14.8	19.5	24.6
WILSON	16.9	22.2	28.3

TABLE 12

PROJECTED PERCENTAGES OF BLACK PUPILS IN THE SCHOOLS

	1980	1985	1990
ELEMENTARY	14.6	16.3	18.1
JUNIOR HIGH	14.4	16.3	18.4
SENIOR HIGH	14.5	17.6	20.8
TOTAL SCHOOL	14.5	16.6	18.8

TABLE 13

PROJECTED PERCENTAGES OF OTHER ETHNIC PUPILS IN THE SCHOOLS

	1980	1985	1990
ELEMENTARY	9.0	11.0	12.7
JUNIOR HIGH	8.3	10.8	12.6
SENIOR HIGH	7.5	10.5	13.9
TOTAL SCHOOL	8.5	10.8	12.9

TABLE 14

PROJECTED PERCENTAGES OF TOTAL ETHNICS IN THE SCHOOLS

	1980	1985	1990
ELEMENTARY	23.5	27.3	30.8
JUNIOR HIGH	22.8	27.1	31.0
SENIOR HIGH	22.0	28.1	34.8
TOTAL SCHOOL	23.0	27.4	31.7

TABLE 15

PROJECTED ENROLLMENT OF BLACK PUPILS IN THE SCHOOLS

	1980	1985	1990
ELEMENTARY	2150	2572	3116
JUNIOR HIGH	929	1082	1317
SENIOR HIGH	954	1126	1370
TOTAL SCHOOL	4033	4780	5803

TABLE 16

PROJECTED ENROLLMENT OF OTHER ETHNIC PUPILS IN THE SCHOOLS

	1980	1985	1990
ELEMENTARY	1323	1732	2177
JUNIOR HIGH	537	718	906
SENIOR HIGH	493	670	918
TOTAL SCHOOL	2353	3120	4001

TABLE 17

PROJECTED ENROLLMENT OF TOTAL ETHNICS IN THE SCHOOLS

	1980	1985	1990
ELEMENTARY	3477	4308	5297
JUNIOR HIGH	1465	1801	2224
SENIOR HIGH	1446	1797	2288
TOTAL SCHOOL	6388	7906	9809

ASSUMPTIONS AND METHODOLOGY

> INTRODUCTION <

The Tacoma public school forecast involved over 4000 individual predictions. These included all the individual enrollment forecasts for each school for each grade and for each year for the next ten years. In addition, an ethnic forecast was performed for each school and each year for both Black and total ethnic groups. To make such a detailed forecast of a system as large as the Tacoma school system, it was first necessary to forecast certain aspects of the entire population of Tacoma. The purpose of this section is to discuss a number of the most important assumptions and the methodology which was used in making the Tacoma public school forecast.

Before proceeding further, it should be noted that when reference is made to Tacoma, what is meant is the entire area included within the boundaries of the Tacoma School District, which extend in some directions beyond the city boundaries proper. For instance, Fircrest is in the District but not in the city; likewise with Ruston and some of Browns Point-Dash Point. Therefore, housing and population figures used in this study will be greater than the city proper by the amounts contributed by these aforementioned areas.

The following sections will begin with a discussion of how the Puget Sound Council of Government (COG) forecasts of the Tacoma population by age group were used. This is followed by the assumptions regarding persons per household in Tacoma in the coming decade. The third topic considers assumptions and methodology concerning new housing in Tacoma. In the fourth section, the problem of forecasting births will be discussed. Projecting kindergarten pupils will be discussed in the fifth section. In the sixth section, forecasting new pupils originating from the new housing will be considered. This is followed by the methods used to move the classes from year to year within a school. A brief discussion of the judgemental method used to obtain principal and staff estimates of enrollment and ethnic percentages will be taken up in the eighth section. In the ninth section, the application of the eclectic method, which includes the amalgamation of both judgemental forecasts and trend forecasts, will be explained. The assumptions used in treating the optional area around McCarver-Bryant-Stanley Elementary Schools will be discussed in the tenth section. The eleventh section will explain how pupils are allocated from elementary to junior high, and from junior high to high schools. Finally, assumptions used in the ethnic forecasts will be presented in the twelfth section.

> USING COG AGE GROUP PROJECTIONS <

The Puget Sound Council of Governments (COG), as part of an ongoing regional forecasting effort, projects the Tacoma area population to the year 2000 by age groups according to geographical areas called AAM's (economic activity allocation model areas) which usually encompass one or more census tracts. The age groups include the following: 0-4, 5-14,15-17, and 18-44 years of age. From these projections, the fraction of the Tacoma population which each of these groups constituted in the years 1980 and 1990 were calculated. The average of these two years was then taken as the fraction for the group over the next decade, the 1980's. These average fractions were used later on to compute the numbers of persons in each census tract that were in a particular age group in a specified year, if the total number in the census tract were known in that year.

To summarize, the COG population forecasts were used only to calculate age group fractions and not to calculate Tacoma populations since COG forecasts were not up-to-date in new housing estimates in Tacoma in the next decade. That is, the COG forecasts were judged much more reliable in forecasting the age group fractions of the total population than the age group population itself. In addition, COG forecasts were the only ones obtainable for small geographical areas since the 1970 census was taken.

> POPULATION PER HOUSING UNIT <

In forecasting the population per housing unit (PPH) in each census tract, the PPH was held constant at the latest year's data, 1978, despite a steadily declining PPH trend in the 1970's. The reasons for this assumption are threefold. First, the PPH turned up for the first time in ten years in 1978, indicating that the bottom may have been reached. Secondly, the birth rate in Tacoma has increased on the average of 10% per year for the past four years in Tacoma and even more in Pierce County. An increased birth rate would cause an increase in the PPH. Finally, the cost of new housing units has shot up very rapidly in the last three years. Interest rates have risen sharply and the current recession may be both longer and deeper than expected. This implies that grown children and even some married couples may stay with the parents while saving to buy their own home. All of these factors would tend to increase the PPH in the 1980's. In conclusion, with the current trends in conflict with the past trends, the assumption was made to hold PPH in each census tract the same in the 1980's as it was in 1978, the latest year in which historical data were available.

> NEW HOUSING <

Housing information was obtained from two sources, the monthly report of new subdivision (plats) and the records of building permits issued. These planned and under-construction units were then separated into two categories: 1) concentrated

housing consisting of 5 or more units in one location and 2) scattered housing consisting of 4 or less units in one location. The concentrated units were allocated directly to the attendance areas of the schools being forecasted. The scattered units were assumed to be distributed uniformly within their census tracts. To assign the scattered units to schools, it was necessary to map the 39 census tracts in the district to the 41 elementary schools, and later on to the 10 junior high schools. The mapping process resulted in a set of equations which produced the number of scattered housing units in each attendance area given the number of scattered housing units in each census tract. Of the 6400 units planned or under construction in 1980, less than 10% are scattered and more than 90% concentrated.

Once the planned new houses for each school are calculated, the assumption was made that all of these units (and no additional ones) will be built and occupied by 1990. It was further assumed, for lack of other information, that the units will be installed in equal numbers per year in each attendance area. It turned out that these assumptions are not crucial except in the case of Northeast Tacoma in which the planned number of units are equal to twice the existing housing stock. In the other attendance areas, the new housing constitutes a relatively small fraction of the existing housing stock.

> FORECASTING BIRTHS <

The births from 1975 to 1979 provide the information to calculate the kindergarten pupils from 1980 to 1984. To forecast the kindergarten pupils from 1985 to 1990, however, it is necessary to first forecast the births in Tacoma from 1980 to 1985, which is a much more complex problem than it first appears.

The forecast of the number of births in Tacoma for the years 1980 to 1985 involves the following steps. The number of women of childbearing age (15 to 44 years) are calculated for each census tract from the COG fractions and from the population forecast of Tacoma by census tract made previously. The fertility rate for each census tract for the next decade is calculated from the most recent known rates (1978 and 1979) and from projected increases in the fertility rate. The assumptions used were that each census tract would increase in fertility by 1.5% per year for the 1980-1985 period and 0.9% per year from the 1986 to 1990 period. These assumptions are based on Washington State projections which in the past decade have followed closely U.S. fertility increases. Moreover, Tacoma's last four years agree with these upward trends in fertility.

> KINDERGARTEN PUPILS <

Projecting the number of new kindergarten pupils in each elementary school in each year was probably the most difficult task

in the entire forecast. As was mentioned previously, the number of births had to be calculated from fertility and childbearing age women according to census tract. These births are totaled to produce city wide births for the years 1980 to 1985, which are then set equal to the maximum number of kindergarten children which could enter the district's schools in the 1985 to 1990 period. It should be understood that the new housing planned for each census tract was taken into account in calculating the forecasts for kindergarten children. Examining past data, it was determined that an average of 12% of the kindergarten children go to private or parochial schools and thus must be subtracted out of the total available.

At this point it is necessary to digress for a moment to explain why the kindergarten children could not be allocated from the census tracts directly to the school attendance areas by means of the 41 allocation equations. In fact, this method was tried but failed utterly in predicting the expected kindergarten classes in the elementary schools in 1980. It was concluded that families with small children cannot be assumed to be distributed uniformly throughout their census tracts. Apparently, families with small children are concentrated in small areas within census tracts resulting in certain schools getting large numbers of kindergarten children and others small numbers. For this reason, a different method, to be described, was used to forecast the kindergarten classes in each elementary school.

For the years 1981 to 1990, the increase in kindergarten pupils in any attendance area was initially made by increasing the kindergarten classes by a percentage equal to the percentage increases in new housing units in the area. At the same time, the city totals of kindergarten pupils, based on the births five years previous, were projected for 1981 to 1990. The 12% private and parochial was deducted and the remaining pupils provided totals against which the kindergarten classes in each year must be summed up to equal. Any differences between the two sums is reduced to zero by adjusting the kindergarten classes proportionally up or down in that year. For example, if the kindergarten class in elementary school x accounted for 10% of all kindergarten school pupils in 1985, then 10% of the difference would be added to (or subtracted from) kindergarten x if city totals were greater (or less) than the sum of the 41 elementary schools in that year. This method resulted in much more plausible forecasts of kindergarten classes in the individual elementary schools than the method of direct allocation using the 41 equations.

> FORECASTING NEW PUPILS <

New pupils result from families moving into new housing units. As new units are build in the 1980's, the number of new elementary pupils are calculated for each school and for each year. This number is distributed equally to the seven grades, i.e., from kindergarten to sixth grade. For 1980 the number is distributed

only to grades 1 to 6 because kindergarten is known from preregistration.

New pupils entering the junior and senior high school grades are computed in a similar way. The total number of pupils allocated to a school in a given year are divided equally among the grades in the school. Any remaining pupils are allocated beginning with the lower classes and proceeding to the higher.

> MOVING CLASSES THROUGH THE SCHOOL <

This section will deal with the methods used to move a class of pupils through a school from year to year. By movement of classes, we are referring to, for example, moving 1st grade in school x this year to second grade in school x next year. Three methods were used to calculate the movement of classes through schools. these are: 1)exponential smoothing; 2)moving average; and 3) the unity assumption. In all three methods, the data refers to the ratio of the enrollment of a class in one year to its enrollment in the previous year.

The exponential smoothing method used the entire 10 years of past data. The smoothing coefficients were set equal to 0.1 which produced relatively low rates of change and gave a lesser weight to the more recent data.

The moving average method used five years of past data each year to forecast the sixth year's data. In the next cycle the earliest year is dropped, the sixth year becomes the fifth, and a new five year average is calculated, etc. This method gives no weight at all to the data in the 1970-1974 period. It uses only 1975 to 1979 enrollment figures and thus is somewhat biased toward more recent changes in ratios.

Finally, the unity assumption was the basis of the third method. Theoretically, if there are no new houses built in a school attendance area and no families moving in or out, then a class should not lose or gain any pupils from year to year. If this ideal situation occurred, then the ratio would be 1.0 or unity. This assumption, which rarely occurs in the real world, is the most conservative of all three.

The calculated ratios from all three methods were weighted equally and averaged to produced a final ratio. This ratio was used to compute the extrapolative (trend) forecast of enrollment.

> JUDGEMENTAL FORECASTS <

One of the key sources of information about the future is contained within the heads of the people that operate the system. The principals and the staffs of the fifty-six Tacoma schools

probably know more about their particular school's immediate future than anyone else. For this reason, it was decided early on to poll these "experts" for their insights into the size and composition of their schools and the most important factors affecting these variables.

Each principal was informed at a meeting as to the reasons for the poll and that the estimates provided would be used in the overall forecast. Each principal was provided with a data form showing the enrollments for the past ten years of all the grades in his (her) school plus the percentages of Black, Other Ethnic and total ethnic pupils for the entire school over the same period. Past Tacoma births for the last ten years was also included.

At the top of the form, a set of blank boxes were to be filled in by the principal and staff. These boxes asked for estimates for the years 1980, 1985 and 1990 of enrollment by grade and ethnic percentages by school for the three ethnic categories. The principals were allowed to use any method they chose and as many or few staff as they wished.

On the reverse side of the form was a list of factors that could possibly affect the enrollments and racial composition in the school. The principals were encouraged to check off the important factors and comment on them if they were inclined to do so. This information was used by the author as background material to understand what was happening, or was about to happen, in the local area.

The judgemental estimates of the principals were subsequently merged with the trend forecasts to produce the final forecasts of each school in the district.

For purposes of including the judgementals into the forecasts for the years lying between 1980-1985 and 1985-1990, the method of straight line interpolation was used, i.e., equal amounts of change from year to year assumed.

> THE AMALGAMATED FORECAST <

The final forecast for the enrollments in the three levels, elementary, junior high and senior high, were made by combining the judgemental forecast with a weight of 1 with the computer trend forecast with a weight of 3. The 3 to 1 weighting was chosen because the trend forecast was really an average of three separate methods of moving classes through the schools. The trend forecast also took into account information which the principals were not precisely aware of, such as birth rate projections and new housing units in their attendance areas.

This approach, i.e., making several forecasts of the same variable and combining them according to some weighting scheme, is called the eclectic method. Experience has shown that the eclectic method is more accurate than any method based on only one set of

assumptions.

> THE OPTIONAL AREA <

In a certain area of the city, bounded by Prospect on the west, I-5 on the south, Division Street on the north and the Puyallup River and waterfront on the east, pupils finishing elementary school have the choice of going to any Junior high school in the city. This area, referred to as the McCarver Junior High area, is one with a high percentage of Black pupils. The objective is to achieve a better racial balance by permitting optional enrollment out of this area.

Data were obtained from the District Computer Center which listed the percentages of pupils going to the various Junior high schools from the seventh grade pupils residing in the McCarver Junior High area in 1980. For purposes of forecasting the future distribution of optional area pupils to Junior high schools, the same percentages were applied to the graduates of the elementary schools in the optional area over the next decade. It was assumed here, and affirmed by District staff personnel, that transfers into and out of the optional area were approximately equal which would allow the distribution method to work.

> ALLOCATION OF PUPILS TO HIGHER LEVEL SCHOOLS <

The District Computer Center personnel were able to provide a complete list of the scheduled allocation of pupils from elementary to Junior high and from Junior high to senior high by school for September, 1980. From these data, percentages of pupils graduating from a particular school who were about to enter a next higher level school were calculated. Using these percentages, and assuming that the distribution of pupils will remain about the same in the next decade, a set of equations was arrived at that predicted the incoming class sizes into Junior and senior high schools. A procedure was also used to make sure the totals graduating lower level schools would equal the totals entering higher level schools.

> ETHNIC FORECAST ASSUMPTIONS <

For each of the 56 schools in the district, and for every year in the next decade, forecasts were made of the percentages of Black and total ethnic pupils. In additon, forecasts of Black and total ethnic pupils for the entire district were made. Projections of percentages of Other Ethnic pupils were obtained by subtraction of Black from total ethnic percentages.

The final forecasts for the Black and total ethnic groups were the result of amalgamating the judgemental estimates of principals and the trend forecasts from past data. In combining these two forecasts, the judgemental was given a weight of 1, as in the previous case of school enrollments, and the trend forecast the weight of 3.

The trend forecast was obtained by straight line extrapolation of past data into the future. This method provided the best fit by far for district Black and total ethnic data over the past two decades. Other methods were tried of extrapolating the past into the future, but the resulting projections were judged implausible and were therefore rejected. Individual elementary school ethnic percentage data often fluctuate greatly from year to year as a result of district allocation policies, choices of the children and available bussing options. As a result, the forecasts for percentages in the individual schools are judged not as reliable as the overall district forecast. In order of increasing confidence in the forecasts, the Junior high forecasts are judged more reliable than the elementary, the senior high more reliable than the Junior high and the district forecasts the most reliable.

ADDENDUM

In the Tacoma-Pierce County forecasts, the definition of the boundaries of Tacoma are the legal city boundaries. In the school enrollment forecasts, Tacoma enrollments include pupils from areas lying within the District but outside the city, e.g., Fircrest, Browns-Point/Dash Point and Ruston.

Handicapped pupils were excluded from all enrollment and ethnic forecasts because of several reasons. Historical data for handicapped is not provided for grades within schools, just totals for schools. Handicapped follow no discernible trend lines in any particular school. The legal definition of handicapped is undergoing change at present and thus the numbers of handicapped may alter drastically. Finally, handicapped are bussed from outside the district.

All forecasts are in reference to October enrollments in the schools. Full Time Equivalents were not forecast. Investigation has shown that a relation exists between FTE and October enrollment in any year. Thus FTE in any month could be calculated if October enrollment was known.

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